REMARKS/ARGUMENTS

Claims 1-22 were pending all of which stand rejected. Claims 1-3, 6, 7, 11, 16-18 20 and 21 have been amended. Claims 23-30 have been added. Reconsideration is respectfully requested in view of the amendments to the claims.

One of the limitations of Claim 3 has been incorporated into Claim 1, such that Claim 1 now recites "depositing the titanium layer onto the substrate by physical vapor deposition" and "the atmosphere in the deposition chamber comprises hydrogen and wherein the hydrogen is activated."

The Examiner rejected Claim 3 under 35 U.S.C. 103(a) as being unpatentable over Baum et al. in view of Besser et al. and further in view of Yamadai.

The Examiner cited these references for the following teachings:

> "Baum et al. disclose a method of forming an oriented metal layer on a substrate where a substrate is placed in a deposition chamber comprising a source of metal, depositing the metal layer onto the substrate by physical vapor deposition (PVD) in a [sic] atmosphere that comprises hydrogen." (Office Action page 4, lines 13-16)
>
> "Besser et al. disclose a method of forming an oriented titanium layer on a substrate where a titanium layer (530) is sputter deposited onto a substrate (500) in an atmosphere comprising argon, then forming an aluminum layer (540), with a <111> orientation, on the titanium layer (530)." (Office Action page 3, line 22, to page 4, line1)
>
> "Yamadai discloses a method of forming a layer on a substrate where a titanium layer (3), with a <002> orientation, is sputter deposited on a substrate (1), then a titanium nitride layer (4), with a preferred <111> orientation, is formed on the titanium layer (3) and an aluminum layer (5), with a <111> orientation, is formed on the titanium nitride layer (4)." (Office Action, page 4, line 19, to page 5, line 2)

The following are the important facts here:

1. Baum et al. teach a method of fabricating an "Ir-based electrode" and "hydrogen or other reducing gas (forming gas) atmospheres in the iridium electrode

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formation step" (col. 4, lines 45-46). However Baum et al. make absolutely no mention of a titanium layer.

2. B sser et al. teach "Ti, TiN and Ti" layers (col. 2, line 11) but make no reference to an atmosphere that comprises hydrogen.

3. Yamadai teaches "forming a Ti film having a (002) orientation" but makes no reference to an atmosphere that comprises hydrogen.

The Examiner states:

> "Since Baum et al. and Yamadai are both from the same field of endeavor, a method of forming an oriented metal layer on a substrate, the purpose disclosed by Yamadai would have been recognized in the pertinent art of Baum et al." (Office Action, page 5, lines 3-5)

The fact that Baum et al and Yamadai may be in the same field of endeavor is not sufficient, in itself, to show a motivation to combine these two references. Baum et al. is entitled "Method For Etch Fabrication Of Iridium-Based Electrode Structures," and Baum et al. are primarily concerned with Ir-based electrodes and, in particular, "the patterning and fabrication of Ir-containing structures" (col. 2, lines 48-49). Applicants are unable to find any references in Baum et al. to the orientation of a metal layer, and certainly there is no reference in Baum et al. to forming a titanium layer with a <0002> crystal orientation. Accepting arguendo the Examiner's statement that the "purpose" disclosed by Yamadai is to form "an oriented metal layer," a person of skill in the art would nonetheless have no reason, from reading Baum et al., to suspect that using a hydrogen-containing atmosphere would be useful in depositing "an oriented metal layer."

The Examiner states further:

> "Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Baum et al. by the titanium layer having a <002> orientation, the titanium nitride layer having a <111> orientation and the aluminum layer having a <111> orientation as taught by Yamadai." (Office Action, page 5, lines 5-9)

The issue here is not "modifying" Baum et al. in the way described by the Examiner. The Applicants do not claim to have discovered the advantag s of titanium, titanium nitride

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and aluminum layers having the abov -described crystal orientations. In fact, this application admits:

> "It is known that when the aluminum layer has a <111> crystallographic orientation, the electromigration problem is reduced. One approach to promoting formation of the aluminum layer in the desired <111> orientation is to form the TiN layer in a <111> crystallographic orientation. . . . Further, it is known that enhancing the <0002> preferred orientation of the titanium underlayer promotes formation of the subsequently deposited TiN and Al layers in the desired <111> orientation .... (Specification, page 2, lines 7-15)

Rather, Claim 1 recites a process of forming a titanium layer that achieves the desired crystallographic orientation.

Moreover, since Baum et al. are heavily focused on iridium layers, the Applicants do not understand why a person of skill would want to "modify" the Baum et al. teaching to include a titanium layer, a titanium nitride layer, or an aluminum layer, as suggested by the Examiner. No apparent purpose would be served by substituting the titanium, titanium nitride and aluminum layers of Yamadai for the iridium-based structures of Baum et al.

What the Examiner is seeking to do is to arbitrarily combine teachings from various references without regard to whether a person of skill in the art would see any reason to make the combination. "The fact that references <u>can</u> be combined or modified does not render the combination obvious unless the prior art also suggests the desirability of the combination." (M.P.E.P., § 2142.01) The fact that *it would be possible* to combine Baum et al. with Yamadai does not support the rejection unless the prior art suggests the combination as well as that making the combination would have a reasonable expectation of success. Applicants submit that there is absolutely no evidence to support these conclusions in this situation.

Accordingly, Claim 1, as amended, is allowable. Claims 2-10 depend from Claim 1 and are therefore allowable on the same basis. The prior grounds of rejection of these Claims are rendered moot by the amendment to independent Claim 1.

Claims 18, 20 and 21 were also rejected under 35 U.S.C 103(a) as unpatentable over the combination of Baum et al., Besser et al. and Yamadai. Claim 18 recites

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"depositing the titanium layer onto the substrate by physical vapor d position of th source of titanium under conditions wherein the atmosphere in the deposition chamber comprises hydrogen and wherein the hydrogen is activated." Claim 20 recites "flowing a first gas comprising hydrogen into the sputtering chamber through a first gas injector" and "sputter depositing the titanium layer onto the substrate." For the reasons set forth above in relation to Claim 1, Baum et al., Besser et al. and Yamadai cannot properly be combined so as to defeat the limitations of Claims 18 and 20. Claim 21 depends from Claim 20 and is therefore allowable for the same reasons.

Claims 19 and 22 were rejected under 35 U.S.C. 103(a) as being unpatentable over Baum et al. in view of Besser et al. and Yamadai and further in view of Hsu et al. Claim 19 depends from Claim 18, and Claim 22 depends from Claim 20. Hsu was cited as disclosing an "aluminum layer having a FWHM of 1.5 degrees." However, there is nothing in Hsu et al. that affects the patentability of Claims 18 and 20, and Claims 19 and 22 are therefore allowable by reason of their dependency on Claims 18 and 20, respectively.

Claims 11-17 were rejected under 35 U.S.C. 103(a) as being unpatentable over Baum et al. in view of Besser et al. and further in view of Miyasaka.

Claim 11 recites "flowing a first gas comprising hydrogen into the sputtering chamber through a first gas injector" and "sputter depositing the titanium layer onto the substrate by applying power to the target." Baum et al. and Besser et al. are discussed above. With reference to Claims 11-14, Miyasaka was cited as disclosing "a method of forming a thin film over a substrate (10) in an atmosphere on [sic] hydrogen in argon with an inert gas." (Office Action, page 8, lines 1-2) The problem is that Miyasaka says absolutely nothing about titanium. Miyasaka is concerned with the low yield and low quality of thin film transistors (TFTs) resulting from shorting between the drain and source regions, shorting between TFTs, low on-off current ratios, and low gate-source breakdown voltages (see, e.g., col. 2, lines 46-52; col. 3, lines 1-4, 6-9).

In the passage of Miyasaka relied upon by the Examiner (col. 5, lines 57-67; col. 6, lines 1-25), a "hydrogen-containing atmosphere or a reducing, argon-containing atmosphere" is used to terminate the "chemically active electron pairs" that are formed during the crystallization of a semiconductor lay r. A person of skill in the art, reading Baum et al. or Besser t al., would see no particular reason to modify Baum et al. or

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Besser et al. to include the "hydrogen-containing atmosphere" or "reducing, argon-containing atmosphere" of Miyasaka in a process for sputter depositing a titanium layer.

Claims 12-17 depend from Claim 11 and are allowable for at least the same reason as Claim 11.

Applicants note that the amendments to Claims 6, 7, 10, 11, 16-18, 20 and 21 are editorial only and non-narrowing and are unrelated to the patentability of those claims.

New Claims 23-30 are supported in the specification at page 8, lines 5-7, and page 11, lines 18-30, and are clearly allowable over the prior art references cited by the Examiner.

For the above reasons, Applicants respectfully request allowance of Claims 1-30. Should the Examiner have any questions concerning this response, the Examiner is invited to call the undersigned at (408) 982-8200, ext. 1.

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